



## West Africa Peering Forum – July 29 2021

**GHISLAIN NKERAMUGABA:** Hello, everyone. Good morning. Good afternoon, everyone.

My name is Ghislain Nkeramugaba, and I am your host today for the West African Peering Forum 2021, and I am delighted to be here.

On the agenda today, we have a good program. Today we will be looking at the peering and interconnection ecosystem in West Africa. Our first panelist will give a brief on the current situation as far as IXP are concerned. We will delve into building large infrastructure communication, where we will have Ndiogou Fall for Orange and Ben Roberts from Liquid Intelligent Technologies. We will move forward and talk about security with Team Cymru. Brian Davenport is on the team today to talk about security. And we will finish with Aderemi Adejumo, who will be talking about cloud infrastructure.

The objective of the meeting today is really to look at what can we do as people who are interested in peering and interconnection in West Africa, what can be done to improve networks connectivity and push high speed and reliable, resilient Internet to the people still

underserved at a low cost as much as possible. That's the reason why we are looking at a large spectrum of things today.

We want to thank our sponsors. Flexoptix is the simultaneous interpretation service provider or the sponsor, and we want to say a big thank you to Flexoptix. We are as well thanks PAIX, WAPF, AFRINIC, MainOne, RackCentre, Facebook, and Team Cymru for make this possible. A big thank you to those who are representing those organizations here.

So the speakers we have today. We have Muhammed Rudman. Muhammed Rudman is the CEO and founder of IXP Nigeria. He will be the one giving his first remarks. Then we will have Ndiogou Fall and Ben Roberts, Liquid Intelligent Technologies. We will have Brian Davenport from Team Cymru, and we will have as well Aderemi Adejumo from Cloudflex. So without further ado, let me ask the technical team to put the first slide and request Muhammed to take the floor to go through his opening remarks. Thank you.

**MUHAMMED RUDMAN:** Thank you so much, Ghislain. Before I proceed, since we are from West Africa, I am delighted with what ISOC is doing here today, but again, all the various stakeholders from the different West African countries to engage with them regarding improvement and peering, all that you have been doing, fantastic job in the African region. But focusing on West Africa now is something that gladdened our hearts. So thank you so much, Ghislain and all the team behind you in ISOC. Thank you so much.

West Africa is one of the five regions of Africa, and there are 16 countries in the region. Out of those 16 countries, there are 13 countries that have IXPs. In fact, in the last ten years , there were only 3 IXPs Nigeria, Ghana, and Abidjan. But now with what ISOC and others have been doing, we have seen significant improvement. We now have 13 countries with IXPs. Those countries that do not have are Cape Verde, Guinea Bissau, and Niger. So about 19% of West African countries do not have an exchange point. I put Sierra Leone there, even though it was recently launched, so in some records you might not necessarily find it.

So this is to just show us what is possible . Of course, Nigeria is leading the way with 271 Autonomous System Numbers from AFRINIC, and the total of around 252. West Africa is

second in Africa. Because South Africa is the highest, South Africa region is the highest with over 800 Autonomous System Numbers, and East Africa is the third with around 316 Autonomous System Numbers. Below you will see the graph of the growth of those autonomous numbers over the years from 2006, and that was the year that some of the West African countries started to establish Internet exchange points, like for example, in Nigeria, we commenced in that 2006. Most of them started around that period, and that's when some of the smaller service providers started acquiring Autonomous System Numbers just to peer at the various exchanges.

So this is the total traffic from all the various exchange points. We have around 355 gigabits per second, and that is the total for the region. And if you compare it with other regions of Africa, it is South Africa that is ahead of this region when it comes to traffic. You know, that's because of the NAPAfrica and Johannesburg and other exchanges in South Africa. Just to give us an idea of the traffic within the region, and the traffic for each country. So Nigeria has the highest population, so of course, it has the highest figures; followed by Ghana, you know, which has around 80 gigabits per second; then you have Burkina Faso, that has around 11 gigabits; while the rest are all small traffic.

Next slide, please.

So that does it. It's just to give a background to the peering ecosystem in West Africa, the countries that have exchange points and the ones that do not have, so it's a very short slide. Thank you so much, Ghislain. Thank you. I will be available for questions.

**GHISLAIN NKERAMUGABA:** Thank you. Thank you, Muhammed, for your remarks. Yes, there are still work to be done in those countries where we don't have exchange point because it is the beginning of the peering and interconnection. It starts there first, and then later on it moves into a bigger ecosystem.

our next speaker is going to talk about the project by Orange in West Africa, and I would like to hand over to Ndiogou just now, who is going to talk to us about the project, and over to you, Ndiogou.

**NDIOGOU FALL:** Thank you. Thank you for allowing me this opportunity to speak. I am the expert from Orange in this area, and as you said, I am going to talk about the project, Djoliba. It's a project that aims to connect the main capitals of West Africa. It's a major project that we began to connect the cities in Africa using underwater sea cables. So I am going to provide some key information, and then I am going to talk about the current situation in West Africa, then opportunities that are available from the Djoliba project.

This is the current situation in West Africa. There are already some connections in East Africa which have already been mentioned, and in East Africa, there is a lot of we noticed there wasn't an integrated network, and Orange is aiming, therefore, to connect the capitals in this region. So we are going to hopefully connect the countries in Burkina Faso and Mali.

So these are the opportunities that are available. The aim is to secure the network in this region using the regional backbone. So we aim to make these networks secure. And the possibility of resolving problems arising from cables being broken, land cables being broken. So this project is aiming to develop the ecosystem. We want to improve the client experience in the region. We want to create an integrated system without going through operators. So we had to do it country by country using national operators. And that was very difficult. And we needed to there were lots of people taking part and had something to say. To go from Dakar without any interruption, it was a difficult project.

So here are the advantages offered by Djoliba. As I said, fiber optic cable through underwater sea cable. So the traffic will travel on the underwater cables, and that way there will only be one point of contact to create a connection between Dakar to Nigeria and reduce the problems. Also, we are very committed to quality, and also, if we are able to deal with problems relating to the cable, the underwater cable. And we create locally managed networks from in Senegal. So here you can see the architecture of 10,000 kilometers of fiber optic cable. So 2569 kilometers in Mali. 3353 kilometers in the Ivory

Coast, and Burkina, 955 kilometers. So we are looking at 10 gigabytes using POPs in each country, from Dakar Ouakam, Dakar Medina. We have some in Mali as well. In terms of the Ivory Coast, we have other POPs, and Burkina Faso, we are also present there. And Ouaga Balkuy, on the border with Ghana, we have other presence there. Accra, Rack Africa, and the Lagos Rack Center. Of course, there are other sites in other countries, but in terms of the project, these are the countries where we are doing the most work on the project.

So here you can see how we have connected the cables overland with the underwater sea cables. We have also connected the Ivory Coast to Burkina Faso, and we can see that we've done this through the cities that are on the border from Guinea, we can go to Ghana and then on to Nigeria. Of course, there is an underwater cable that links these, so there are three ways of connecting this network.

So here you can see the structure of the network, which is made up of IP equipment that are interconnected, and it's the IP network that's going to give us sufficient capacity, transmission capacity, and the interconnection between the various countries. So you can see the route that the connectivity takes right to Nigeria from Senegal.

This is WDM architecture, and it's based on the same principle. Fiber optic cables have been deployed in different countries, and it goes from Senegal to Mali, Cote d'Ivoire, the Ivory Coast, and potentially on to Liberia and Sierra Leone. You will see that in the following slides.

So Djoliba, this is what it can offer at the moment in terms of 85 POPs available across the world and 13 POPs in Africa. So we have our strategy for growth has allowed us to create a connectivity in this area of Africa and go from Dakar to Nigeria. So these are the areas that we have created the connectivity.

So it's been a very good strategy in Africa. It's a more dedicated and singular approach. Before it was difficult to create links between countries. Each operator, we had to

negotiate with each operator, and obviously, there were issues of competition, but thanks to this implementation of Djoliba, we are able to provide a transmission network that connects these countries much more easily, either using an international private line or an EVPL, and 100 gigabyte transmission level.

So this shows you the solutions that Orange are able to deploy using Djoliba with allowing free access to mobile data thanks to these networks. And the networks will be far more extensive in Africa, and of course, all of the services will benefit from Orange's portfolio of security.

This is how things were before. So if there was a client or an operator in Dakar, for example, they had to go down, in order to connect to Ouagadougou, they had to go through different operators, and they had to negotiate with Sonatel or other operators to connect through this link. But each operator had to negotiate with operators in every country. And they had no choice about who they had to negotiate with. Therefore, we have overcome these problems, these difficulties.

And now, this is the Djoliba network. You can see that we have created a cluster and, therefore, it's a centralized network that we can offer from Senegal, the Ivory Coast, on to Nigeria, end to end network. And the network is able to it's one single connectivity network with one single point of contact. And thanks to Djoliba, it's possible to be connected in this area of Africa. It's very simple, and it's very simple to be negotiated, to negotiate the transmission and the access and connectivity.

And that's Djoliba. It's not going to stop there. It will continue to other countries, Liberia and Sierra Leone and Mauritania, so that would be the next phase, and this will be an integrated network. At the end of 2022, we hope to have a fully integrated network over those countries.

**GHISLAIN NKERAMUGABA:** Thank you very much. You have even answered the question already about Liberia, which was asked in the Chat, and you have answered that. It's going to be dealt with.

Thank you very much indeed, Ndiogou. You can have a look at the questions in the Q&A and perhaps answer them directly. Then we will have an opportunity to ask more questions.

Ben, it's over to you. Tell us more about Mombasa to Kinshasa.

**BEN ROBERTS:** Hi. Thank you, Ghislain. And welcome, everybody. So my name is Ben Roberts, and I am with Liquid Telecom.

So yeah, so I really want to talk about Mombasa Kinshasa. We have recently changed our name from Liquid Telecommunications to Liquid Intelligent Technologies. Internally, we call ourselves LIT. Today I will be saying Mombasa to Kinshasa is LIT, and I will be suggested that Africa is no longer a dark continent.

I have said things before, but just to recap, we have seen a few trends during the pandemic of traffic on the Internet. We have seen traffic shifting from I think using Internet in the offices a lot to using Internet at home, but more importantly, we have seen an uptick in collaboration, this is adoption of Microsoft Teams, Office 365, but we have seen a huge uptick in collaboration, video, and file sharing as we are working in new and different ways in the pandemic, and even this webinar is a demonstration of this. We wouldn't have been doing this two years ago. We would have gone and meeting in Lagos or something for this meeting. So it's a demonstration of what we are doing. So traffic on the Internet is shifting between networks, but it's being exchanged at IXPs between the consumer networks, business networks. But traffic is predominantly shifting to Cloud. And IXPs are being used to exchange traffic between operators.

The new normal, it's exposed the digital divide, but it's made us, as humans, transform in the way we do things. We have had to adapt. For those that were quite digital anyway, we have changed our digital habits, put it that way.

I am going to recap because I am going to talk about latency and the laws of physics. It's pretty simple theories and some constants, which basically tell you what the RTT, the latency is. It's a factor of distance. So if you have a glass, that's about two thirds the speed of light, and the delay is really caused by the distance between two points on the network. As a couple of physicists here, Isaac and Newton, but underneath that is Captain Scott of the Starship Enterprise, and he was an engineer that did a lot of great engineering things, but he recognized you can't change the laws of physics.

So in 2018, I talked about Mombasa Kinshasa, but I talked about how traffic was routing across South Africa from east to west. Back then, although it was only about 4,000 kilometers, the shortest route from Mombasa to Kinshasa, it is taking a lot longer, should be 38 milliseconds, that latency, by distance. But taking a lot longer. Traffic was coming from Mombasa, it was heading to Europe, going into France, going into London, and then back around to Kinshasa, so we were seeing traffic exchanged in Europe, but more importantly as well, between English speaking and French speaking countries. We are seeing traffic passing through both Paris and London in particular. So that was taking about 300 milliseconds of latency, so it should have been 40 milliseconds, and it's taking nearly 300.

So things have moved on. We have been busy building infrastructure. We are working hard on these routes, but there are about three we are really working on across the continent, but the southern east west route is complete, which is going all the way from Kinshasa, going into Tanzania, crossing Africa that way. We are working on a pink route, you see there, is between Kananga and Rwanda, which will make it even shorter. But just on the left you've got a picture of Africa at night, and this is the lights coming from street lamps and other things. And you see that these new routes are really crossing large areas, which are not completely dark, but pretty dark. Not as dark as Sahara, but we are lighting up fibers through areas which are actually quite highly populated, but they have big spaces in between of uninhabited land or dense forests, which you know, are causing some which have hindered progress in building the infrastructure, put it that way. So the roads and other infrastructures across these regions have been underdeveloped.



Now this is what has changed in terms of latency.

This is the route which is active, the southern route, Kinshasa, Lubumbashi, Zambia. It's limit is 72 milliseconds. It can be 150 milliseconds. Signal IP equipment and MPLS equipment adds on a bit of time and delay to any end packets being moved, but we are really getting quite close to that. And then when the route is finished, it will knock it down. That's a big difference, from satellite latencies to 15 milliseconds, it means you can play Internet games with each other, multi player video games. You can do other things that were not available with the high latencies that were there.

Now, as well as reducing latency, these new routes that we are deploying are impacting millions of people by addressing gaps in what we call the first mile or the middle mile. The first mile is the sort of main routes to get from sub sea cables or peering points to the main cities, so in South Sudan last year, we first got into Juba with the first fiber into Juba, so addressing the first mile issue. In the DRC case, that route is accessing cities Sango, Bindu, these are not small places, not villages. These are places with over a million people, some of these places. Very populace settlements and large places that have never had fiber before, only relied on satellites and high latency. So really making a difference on the middle mile.

But it comes with some challenges, and you know, just mentioning Juba, I haven't got any pictures of this to show, but I mentioned before we had to do quite a lot of demining on the routes. There was a lot of unexploded artillery from recent conflict that prevented such infrastructure from being built. And in DRC, we have some quite enormous river crossings to do here, and there are no bridges. We are looking at using pylons to cross these rivers. This is not even the River Congo. This is near I can't remember the cities, but it's over a kilometer of water we have to cross with fiber optic cable. Things we have done before. When we are doing things like this, although we are crossing fiber and using pylons, we have been deploying and using free space optics technology, what we call FSOT. We used it some years ago to cross the what was it? the Limpopo River, but now the bandwidths available on this technology are much higher, and the devices we are using, free space optics, capable of doing two times ten gigabits per seconds, so quite high bandwidth to cover short distances, much more capacity, and you can get radio links.

The other picture on the right, this is the N2 route, the route we are taking from Kananga to Goma. This is the route. We are building fiber in areas where roads have not yet been constructed. I think at some point roads will come. There's been a lot of infrastructure development across the continent. But there is some of the engineering challenges we are having to solve. And you know, we announced last week that this route was being built in partnership with Facebook, and obviously one of our sponsors today. Part of the partnership we have with Facebook is just working together to solve these challenges. And they have got some good engineers at Facebook, and they have got unique techniques of satellite imagery and artificial intelligence, adding skills to what we can do with our people on the ground and our knowledge and experience of building fiber. So working together in partnership to solve some of these massive challenges that we have to deal with.

I am going to come back to digital divide, one of my favorite subjects at the moment is talking about education is the key to unlock rural connectivity. But much as we are doing relevance all the time in the first mile, middle mile, there is a lot of development that needs to be done on what we call the last mile, which is connecting up villages, communities, people, and schools. So we have done a lot of work in this regard, but I think the pandemic exposed the digital divide, but no more so than in education. So it's going to be our aim to carry on to universities and to try and impact all the schools that we can connect.

Part of what we are doing which is unique on the DRC project, we have a school mapping project where we are mapping out all the schools in the area where we operate. But as we are building the fiber in DRC, our contractors on the ground are not only building fiber, but they are also collecting data to tell us where the schools are, all the schools that are near the fiber. We are mapping those out and showing their proximity to the fiber with an aim to getting them connected. So you know, we will obviously put the fiber in first, but then we know where we are, so we have the information, we have the data so that we can sustainably get connectivity to the settlements close to the fiber, not leaving anyone behind. When we are building long distance fiber, where there is a small village, there is a school, we don't want to leave that community unconnected.

Then the big impact of kind of megatrends going on in African networks is that globally, there are a lot of cloud providers, cloud is expanding and being invested in. We are seeing investments where you have hyper to users being developed. We are seeing in other cities like Lagos, Nairobi, the case for edge caches, where they are being put in to tap into data. All this is part of the development. Having the east west routes, it's not just about connecting those areas to the unconnected, but it's going to enable users in Lagos, in Kinshasa, anywhere in West Africa to access those routes, to access Cloud servers in Nairobi, Mombasa, United Arab Emirates in the Middle East, while it's going to be speeding up and reducing the time it takes to process packets. It's going to impact our quality experience when using cloud.

Then the 2020 figures showing gradual expansion of the intra African traffic. We are seeing still in the West African perspective a lot of traffic flowing between Nigeria and Ghana, and I think the figures that Muhammed showed for the capacities in the Internet exchanges I think are proof to this. I was very surprised and interested to see how much traffic is being exchanged in Burkina Faso. That was unexpected for me. But we are starting to see more of the West African being interexchanged between the countries, and the Orange network will be developing that as well.

But what is going to happen is as we get more as cloud is going to be developing in those major cities, cloud will be developing in Lagos and Kenya, in South Africa, more cloud coming, we will see more and more of these routes, we will see more traffic flowing to West Africa, particularly Nigeria to Kenya, but we will see DRC to Kenya as well. All using these paths, these superhighways. It's not just about Congo. So it's going to be influencing all the way the traffic flows. And I think in about 2014 there were some sub sea cable cuts in the Red Sea, multiple cables were cut, and at that time, we called up SEACOM and asked them to move up all our capacity we had going from East Africa to Europe, we moved all that capacity between East Africa and South Africa, and these events that have happened have changed the way that the traffic have flowed. And I will probably predict that at some point cables going from West Africa towards Europe will probably get cut, and then we might see a shift, a change in behavior where West African networks will suddenly start sourcing their Internet from South Africa, from Kenya. We need more interconnection between the big networks and big backbones in the region.

But then just lastly, I want to touch upon digital trade and digital innovation. I think what excited me most and we talk about the Africa free trade area, but all these emerging tech startups are (video froze) that is going to be afforded by this inter African connectivity. It's going to enable Nigerian countries to spread their services to East Africa, Southern Africa, and North Africa. I think for me that's an exciting point. Other industries like banking, as well, will benefit from this. But for me, it is the this is the growth area that is going to be fueling the growth of future networks. So thank you very much. I am looking forward to having good questions. Thanks.

**GHISLAIN NKERAMUGABA:** Thank you, Ben. It's really packed and full of questions, and probably you mentioned and that will be probably a question to think about, but it will be my first question when we go to Quan. So you talked about the civil engineering challenges. So should we assume that all the other challenges, like cross border, are no longer there? Those are the things that we want to know more when you have when we go into the Q&A session.

So just for a minute, not to take too much time on the presentation, let me welcome Brian Davenport from Team Cymru, who will just give us his presentation on security. We talked about infrastructure. Ben touched a little bit about cloud solutions, so how do we secure all these in exchange points? Brian, over to you to talk about what Team Cymru is doing.

**BRIAN DAVENPORT:** So first of all, thank you for having me on, and I was just looking, you got over a hundred attendees, so that's really awesome for the first one of these. So again, thank you all for your time.

So just myself. I will go through this really quick. I am part of the outreach team here at Team Cymru, and basically, what we do is webinars like this, and we build free tools for the community. Right? So who doesn't love free stuff? Team Cymru, in and of itself, has multiple divisions, which I will talk a little bit about, but really, we are going to focus on how you can use the free offerings that the outreach team has built as an IXP or an ISP to help secure your infrastructure and kind of what that means.

I do have a dog, and normally you would see the dog sleeping behind me, but I have the green screen up today, so I got the background going.

All right. So outreach. So free tools are awesome. We really we have two more that are going to be announced soon that we have been working on. But the really popular ones for, like, IXPs and ISPs are the bogon reference, which we have. So we kind of grab all of the IP addresses that shouldn't be allowed out on the Internet, so you can think of private addresses, addresses that have not yet been registered, and basically provide that as a list you can download. So people will use that for traffic filtering. Right? So not allowing bogons on the Internet. It's a free service. You can peer with us to grab the list, and it's really popular. People sign up for it every day.

Nimbus is one that we have recently built, and what we kind of saw was there's a lot of, like, enterprise grade or even open source NetFlow collectors that you kind of have to build yourself. But we thought we had a really interesting place to fit by offering a free flow collector. And really, if you don't know much about Team Cymru, that's fine, but the enterprise side of it or I guess the part of the company that keeps the lights on, right, and sells product really has a really high fidelity host reputation list. So it's regarded as one of the best in the world. You can think like antivirus vendors or firewall vendors might subscribe to that list in order to OEM it into their product. What Nimbus does is it allows for that particular ISP to get the host reputation list for free in reference to the IP addresses that they transport. Right? So basically think if you are an Internet service provider, all of the traffic that's going across your network you can compare to these host reputation lists for free and it will give you alerting and also give you statistics on peering information. But really, the goal there with most of these products is to give away or give back to the community in a way that they can get some of this technology that's sometimes prohibitively expensive for free, and from a service provider, it's great because, you know, you can provide downstream reporting to your customers, or if you are an IXP, right, in a lot of your the people that are peered with you are utilizing something like Nimbus, it's a way to monitor all the bad traffic and try to reduce that, so more bandwidth for everybody.

And then Unwanted Traffic Removal Service or UTRS. Again, DDoS mitigation can be very expensive. This is a community DDoS mitigation project that has close to 2,000 members or 2,000 ISPs would be a better way to say that, and some very large ones that we are very

thankful for participating in it. You can kind of think of it as remote trigger black hole but a little more global where Team Cymru facilitates it as the steward of the announcements. So Internet service provider A or entity A is under a DDoS attack. They can make a BGP announcement to Team Cymru, and then we basically propagate that announcement out to everybody within the UTRS ecosystem, and locally they will black hole the traffic. It gives you all this traffic that's flowing across here that shouldn't be, it gives us the ability to cut it off locally at each ISP that's participating in UTRS. And we have UTRS 2.0 coming out, which is going to add a lot more features like flow spec and some more IPv6 support.

Yeah, but totally, [teamcymru.com](https://teamcymru.com). Go to Free Services, it's all free to use, feel free to sign up, check it out. If you have any questions about anything, feel free to put it in the Q&A.

Also, for CSIRT, this is one of the ways we try to make the Internet a better place as well as the anybody that's in national SIRT, we will actually give them the entire reputation list for their region, so their whole constituency, so it gives them the ability to see, for the people that are kind of within our organization, you know, what kind of bad traffic are they producing, and then there is an ability where they can send daily reports to the people within their constituency to help them gain visibility into the traffic. We also do some consulting with them on best practices and stuff like that. The CSIRT Assistance Program is for Team Cymru to extend their reach out there.

Then we host a bunch of events. There's four major ones a year. We try to go to locations throughout the world. It's been a little difficult, obviously, with COVID, so we are doing our RISE event in the U.S. this year, but we will have our underground economy event abroad. But we do a bunch of webinars, stuff like this. You can find out about all of that stuff on our website to see what we are up to.

And then there's just a mail list that you can subscribe to, which is a way to just inform the community about what's happening in the information security space. So it's a once a day email, and you will get topics of what we are seeing happening. We try to keep it just lightweight, bullet points, here's what's going on. You can kind of see the different things you'd get alerting on. It is vetted, do we do there's like an approval process to get on it, but it's not too prohibitive. So if you sign up with a legitimate email address, we are able to

figure out that you are a real person, you will likely be added to Dragon News Bytes, and I encourage to you do that.

Then the last slide is just a little bit about Team Cymru. As I mentioned, there is an outreach division, which is really cool because our job is to create free solutions and give them away, and then interact with the community, and it's really interesting to work for a company that is founded by people that helped build the Internet and wanted to dedicate a portion of the company to give back to that. There is also running any business, there's themes that Team Cymru sells, so there is a whole enterprise grade of different software that's available there as well. But it's mostly for, like, enterprise customers; whereas, outreach is more focused on Internet service providers, Internet exchanges, or the community as a whole.

That was quick. I've got two minutes left here. What I will do again is just say thank you. There's a couple helpful links there. If you are interested in Nimbus at all, again, it's for collecting NetFlow, but NetFlow is a very generic term, so NetFlow, sFlow, JFlow, all that stuff. If you have any questions at all about NetFlow, I have been working with that protocol for about a decade, so I can help you configure devices, understand what it looks like, show you how the data is correlated to the lists, all that kind of stuff. I do that very frequently in my day to day. Take a look at UTRS, our DDoS mitigation project. Again, we've got about 2,000 people in it today. Everybody that joins the better it gets because it's a community driven DDoS mitigation portion.

And then connect with us on social media, and if you are on LinkedIn, there's like a hundred people out there, if you find me on LinkedIn and connect with me, I love seeing who I am presenting to or talking with out there. Just I think the previous presenter was saying how it's like this new normal of we are doing a lot more webinars, so it's always nice, doing these things in the past, where you could do them face to face. It's nice to actually see the people out there. If you are on LinkedIn, definitely send me a connection request. I try to only post meaningful stuff when I do post, so I won't spam you. But that's really it.

So I got it done in nine minutes. Thank you all. I am going to stop sharing my slides.

**GHISLAIN NKERAMUGABA:** Thank you, Brian, for these insights. I think the community, the exchange point community, will be very, very glad to work with you more, and I think they will benefit from it. And the whole ecosystem will benefit from it. Thank you very much.

Last but not least, let me welcome **ADEREMI ADEJUMO**, talking more about building Cloudflex in Africa, lessons learned. As well, Ben mentioned that we are going cloud, so let's hear from someone who has already started. Aderemi, the floor is yours.

**ADEREMI ADEJUMO:** Hi. Thank you so much. So Cloudflex started in 2016. Our idea was that we wanted to set up a cloud locally in Nigeria, and this was long before COVID, but we just felt that there wasn't anything like that here in this region. And we wanted to put something here so that at least we can have something that is local to our market and also to the region.

So we started with RackCentre. It's quite interesting because when we sent out information and we try and describe to people, they don't believe we have data centers in Nigeria, and they don't believe we have international grade data centers in Nigeria. So we have RackCentre as well as others, so we start with RackCentre. We went for Huawei equipment because of the cost, and we chose VMware as our hypervisor layer.

So we built two cloud platforms. One is in RackCentre. The other one, which is a tier 3 data center, we built a second one in CloudExchange, which is a tier 4 data center. Our third platform is going to be in the next month or two, which is going to be in the Liquid telecom Africa data center. They are building a new data center in Nigeria, so we are going to be in there. The reason behind that behind the strategy is to open us up into the African markets because, as the previous speaker spoke, what Liquid what LIT is doing, Liquid Intelligent Technologies, are doing is to interconnect Africa. So by us being on their platforms, it's our gateway into Africa, the African market.



The other thing mentioned are the fintech platform and businesses in Africa, is you have a business based in Nigeria that wants to do business in East Africa, so we want to be able to take advantage of that connectivity, that we will have a platform for Nigerian businesses, and they can do business in these other countries with the connectivity as that is developing. So that's the idea behind that.

So we are also VMware verified. We have a DevOps platform. I put this slide in just to show the reason and the benefits of us being with VMware, because VMware don't see themselves as a cloud platform as much as they have platforms within platforms. So they are existing in all the platforms available. So AWS, Azure, Google, IBM, and so on. So there's an interconnectivity and the ability to interchange in the cloud platform from all these different players in the market.

Ghislain mentioned about the challenges building a cloud platform in Nigeria, it's more leading towards the hyperscalers, Azure and AWS. But for us here in Nigeria, what we try to do is build something local, so we take advantage of being local. I think it was Brian talking about the latency and all that. So we have a latency of less than 50 milliseconds thanks to what Muhammed Rudman talked about in terms of the IXP and the interconnectivity in Nigeria. Without IXP, our traffic would be routed to Europe before coming back to somebody who is sitting in Nigeria as well. But with the IXP in Nigeria, our traffic is local, and it's reduced our latency to less than 50 milliseconds, much better in some networks depending on what we have there.

What I did was to put the sub sea map in here to show what it looks like. There are eight of these available in Nigeria at the moment, and what that does is that reduces the cost of Internet in Nigeria, and I think the next slide shows the next two that are coming up, which is quite interesting, which is the one by Google and Facebook, which I believe it's going to be better that you have two companies that lay their cable and I think I would say without debt. I think that's going to make the prices to become quite interesting. And also as a fact that the world sees Africa as the next large market, there is that huge investment in these sort of capacities and these sort of things coming in, in conjunction with what Liquid Intelligent Technologies are doing as well. So what you have, interconnectivity from the world, interconnect within Africa, I think it's making the future of Africa rather interesting and also greater connectivity.

So this is just a table showing the data centers we have in Nigeria because, again, as I said, people are not really aware of the development of data centers in Nigeria. Without a data center, we can't have a cloud platform in Nigeria, so we are dependent on this. And the fact that there is a lot of investments in here and a lot of international standard data centers in Nigeria makes it quite easy for us to develop and grow our cloud platform.

This is just showing the tiering and the definition of the tiering. This is quite interesting because one thing I will say whenever I give this talk is to talk about experience with data Center, we have been there for six years and have never had a minute of downtime with them. I think the testament of the quality and what has been done in Nigeria and of the team that were able to give us such a platform and give us such uninterrupted service.

So this is just showing what we did with our cloud platform. Basically, we have, again, people always interchange between cloud platform and the data center. We have our hardware in the data center. We have our hypervisor layer. And we have our VMs in there. So our ecosystem is working with RackCentre, CloudExchange, and African Data Centre, which is Liquid Intelligent Technologies. We use Huawei because of the cost and they are boots on the ground, so we feel comfortable with the support we get there. We have VMware. We use Veeam for backup. We use Cloudian for SDN storage. We have a platform there so we can provide services in terms of backup, archiving, and any data storage requirements that are required on there. And we use Fortinet for our edge firewall. Even though VMware has its own firewall infrastructure internally, we have this as a secondary firewall. And the reason for this also is it allows us to give the virtual reins to our customers and hand over the control of the edge firewall to them and for them to be able to do their own configuration and have a degree of independence from us.

So that's just showing more of the cloud architecture.

So this is just showing VMware bought Bitnami, the marketplace. Also this is showing our DevOps infrastructure, the DevOps setup we have. We have set up the containerization and Kubernetes facilities on our platform, and we have a couple of customers that have development team that are using our platform for their development.

That's just showing more of VMware's stack.

So these are the services we provide infrastructure, backup as a service, storage as a service, archiving, disaster recovery as a service. The two data centers we have interconnected, so we provide primary and backup cloud platform from that. Again, one of the things talking about the challenges and the development is that we use local connectivity partners to provide the interconnectivity between the data centers and also with our customers. So the large customers have their own dedicated VPN onto our platform, and the smaller customers just go through Internet to get onto the platform.

So just showing the advantages of the local cloud platform. There's a lot of talk around the data sovereignty and data localization, even though it's not being enforced in Nigeria at the moment. Data latency, as I mentioned before, we have very good latency. Latency throughout Europe is about 200 plus milliseconds, where we have less than 350 milliseconds. One of the differences between us and the companies, the hyperscalers, is that we don't charge shall I say the connectivity community don't charge for the egress costs. One of the things we have seen is that we've had a devaluation of nearly 60% this year in Nigeria. So because we operate a local currency, we are able to maintain our prices. Cloud is moving from sorry, it's the other way around moving from capex to opex, and you pay for what you use. One of the developments I see in the future is what this is talking about, the local repositories. There's no local repository in Nigeria for music, talking about the Spotify or Apple Music type, they are not local. Nothing for our films. Most of the local firms, the third largest in the world, but the majority of that is on YouTube rather than a local platform. Large datasets, talking about machine learning and such. In order to develop such things, there must be large datasets locally with local data that this would be used for, and also credit agencies. We have dispersed credit agencies in Nigeria, nothing with a reflection of the country or with the region.

So just showing the different things, the communities that have local cloud and the international companies in comparison with that.

The economics. Again, I think some of the things I have mentioned, and what's mentioned by other speakers about the working from home and increased requirements of cloud infrastructure. We have seen a boost in requirements, in people coming on board over the last 18 months because of COVID, and we are purchasing more and more in terms of improvement of our infrastructure, as mentioned by the other speakers as well, connectivity within Nigeria, connectivity within Africa, and also the expansion of the data center.

Just to round off, I have this slide showing the investment across Africa I mean, in Nigeria, investment in rack center, investment that Liquid Telecom are bringing into Nigeria with the data center, and other companies are doing the same as well. So there's growth, there's investment coming in. The challenges are not enough of local government giving us support. Not enough a lot of the cloud is going outside Africa rather than in Africa. I think one of the speakers mentioned about them just putting edge devices in Africa, so that they reduce their latency to them. But really, there's no proper infrastructure of cloud in Africa like that, apart from what we and some of the other companies are doing to provide cloud computing in Nigeria and also in the region as well.

Thank you for your time.

**GHISLAIN NKERAMUGABA:** Thank you, Aderemi, for your presentation and insight on cloud services. I think it's very insightful.

We are going to run a poll, but not now. I want to probably ask one or two questions for verification as far as cloud is concerned, and then probably we can run the poll in the next one or two minutes.

So Ben mentioned about us going cloud. Aderemi mentioned that there are advantages to sit in Africa and serve the market in Africa. So what I want to know is because cloud and the digital services, it's a value chain, so what challenges are you encountering in building cloud infrastructure and bringing music onboard, movies, all those industries on the

platform? What is being done to bring those industries on those platforms? Because you can build the nicest platform, but how can you put those industries on those platforms? What are the challenges that we are meeting?

**BEN ROBERTS:** I very much enjoyed Aderemi's presentation, and what he is talking about is actually critical. It's big datasets that you want to have. You need to have local cloud everywhere, I would say. Every country in Africa is going to have local cloud entrepreneurs like this. And big hypercloud guys, they are they are not going to come to every single country in a very short time. But filling the cloud is the key. And talking of music and stuff, you know, I think getting in the consumer space, not many people are necessarily used to paying for digital services. You know, so even music, a lot of people might buy music very cheaply, they are just buying CDs on the roadside and stuff like this. So you look at a company like iROKO, and Jason Njoku talks about most of his money coming from the U.S. people listening to African music. There is a lot of music and film content coming out of West Africa that can be shared across the whole content as a marketplace. And I think it's a good opportunity. But it's just about getting people used to paying or finding other business models. So there are companies like Mdundo who are doing music, and they are doing it more on advertising funded. It's looking for alternative business models that are going to make sure the performers get paid. But ultimately, people are putting their content on YouTube, and they are getting no revenue back from this. They are putting things on music platforms for the big hosted and private cloud, like Aderemi's cloud, then they can manage their content and get the development we want to see.

**GHISLAIN NKERAMUGABA:** Modernization and business models.

Aderemi, did you have something to say about the question or you didn't hear the question?

**ADEREMI ADEJUMO:** No, I didn't hear the question.

**GHISLAIN NKERAMUGABA:** So I was saying as cloud platforms are being built, how do we bring those industries on those platforms? What challenges are you meeting to bring the music, the film, all those industries on those platforms?

**ADEREMI ADEJUMO:** I mean, that's something that needs to be done, but it's not something that can be done by the cloud platform only because the cloud platform can put the music or the films on there, but the outlets and the delivery.

So take Nigeria. Nigeria is a country of 200 million. The people who have that monthly subscription of Internet and have all these services and have access to YouTube are less than 5 million of the 200 million. So when you look at our GDP per capita of \$2,000 per year, we don't have the funds to be able to do that. So the the way to get to them is through the telcos. But the telcos are not providing that platform to get the masses for that and to make it a viable system at the moment. So that's where the bottleneck is. Once that is solved, then you will get that audience, and you will be able to make it worthwhile to Monday they advertise having a platform for that in country.

**GHISLAIN NKERAMUGABA:** Okay. All right. Thank you very much. I think we are going to run a poll quickly if team can help me. We are going to run a poll. So we have a question here. It is both in English and in French. It says in your view, what constitutes the biggest challenge to a developed peering and interconnection ecosystem in West Africa?

So you will have to answer what do you think is the main challenge lack of capacity, lack of investment, lack of enabling policies, lack of coordination among the member states? You can poll, and we can let it run for a few minutes few more seconds.

Okay.

So, is it the lack of capacity building and training programs, lack of investments, lack of enabling policies and regulations, or lack of coordination among the member states that constitutes the biggest challenge? We are interested in your opinion on this question.

Okay. So lack of capacity, 9%. Lack of investment, 35%, people think that it is a lack of investment. 33% of people think it is a regulation issue. And lack of coordination, it is 22% of the attendees that think. So the two highest ones we have is lack of investment and lack of policies.

Probably to ask the panelists, we have seen the civil engineering challenge from one perspective, but what are the other challenges that you think can help develop the peering and interconnection ecosystem in West Africa, a general question for all the panelists. Feel free to start, whoever wants, Rudman or Ben or Brian or Aderemi.

**MUHAMMED RUDMAN:** Okay. This is Muhammed. It's actually a combination of not only one. That's why maybe the poll that you are seeing, you see those responses. It's a combination of some or almost all of the above that you mentioned. The lack of capacity building, if you look at this for some of the smaller countries in West Africa, for some do not even have exchange point. Some of them do not have the competent people to even begin to set up the exchange. I believe as ISOC, you are aware of that, and that is why you are providing capacity building. You go onto sites to build exchanges.

For some it's that you go to some of the African countries, they have the major incumbent operator, usually owned by the government, and they really don't care about peering and interconnection. To them, everything is working fine. You know, the more people are going on transit, the better.

To some, you know, it's also the lack of enabling environment. The policymakers, the decision makers, especially the regulators, really do not care. For some you have to get licensing to set up an exchange point. For some of the countries you don't need any license; you can just set up an exchange point.

And cross borders is the last one, the lack of coordination among member states. For example, in West Africa reason, we have what is called WATR, the West African Association of Telecommunication Regulators, where all the regulators work. In terms of this peering

system, I have not seen any. They are mostly for cost on the telecommunication companies. They have not really looked into the Internet, the peering ecosystem and how it works. That's why we are trying to reach out to government in Nigeria, for example. Right now our regulators are the ones chairing the WATR, and we are hoping maybe they will create a summit within the ecosystem in terms of this peering and interconnection because some of the challenges we identified is that the cost of transmission capacity between the African countries is extremely high. You know, sometimes it's much higher than going to the Internet and, therefore, there is no justification for any South African region to connect to the Nigerian IXP because of the high cost of the transmission capacity. Usually it's up to 80% to over 100% of the cost of transit that you would have paid. So I think it's a combination to me. If you ask me, that's why you didn't see, you know, you can see 35, 35, 20, so it's a combination of almost all, if I may say so.

**GHISLAIN NKERAMUGABA:** Okay. Thank you, Muhammed.

Does anyone want to take it up?

**BEN ROBERTS:** Yeah, I would add to the policy side. I would say that consistency in principles of data protection and ideas around data sovereignty would be key for me. And ultimately, where we see inward looking data sovereignty policies, where regulation comes out, says you must keep all your data here in this building, in this country, in this city, you know, they are bad; right? They are bad for the development of the ecosystem, and you know, I think even services we've seen being band, apps we have seen being band in Nigeria, again, can be retrogressive.

When we look at historical ICT policy, it has been there from before, and it's about controlling access to information. It's about limiting the number of players, about limiting the number of people who have phone lines. Over the course of the last 30 years in Africa, we have seen a deregulation, seen more competition opening up, South Africa, Kenya opening up in a big way. But more countries in West Africa are having, you know, smaller number of players. Countries like Ethiopia, as well, have been now opening up. So it's the opening up that changes the landscape.



And Muhammed mentioned WATR, and I remember a member from WATR saying regulation in West Africa were different. They were there to protect the incumbents, basically, is what he said. And while that is the case, that is nothing is going to change, so you know, we are seeing developments. We are seeing what Orange have done connecting countries is good. But ultimately, more countries with more competition is going to be the best way forward because then you get more players to peer and interconnect, and you get a bigger growing digital economy ecosystem.

**GHISLAIN NKERAMUGABA:** Thank you. Thank you, Ben.

Thank you. I think let's go into the audience. We have some questions that are opening up. We have a question from let me see the person, but it is what are the key benefits of Djoliba project to the national governments and IXPs in the West Africa region, and how much bandwidth is available within the Djoliba West Africa?

What are the benefits of Djoliba for IXPs in West Africa, and what is the transmission capacity, the bandwidth? I think you said 100, 10 by 10. Is that right? But also, what are the advantages of Djoliba?

The other question was about Liberia. I think that one was answered. There was a question to Muhammed Rudman.

**MUHAMMED RUDMAN:** Okay. So what I am saying is it all depends on the country's maturity when it comes to the ecosystem, the peering ecosystem. So the first one to set up a private exchange, community based driven exchange in South Africa because South African ecosystem has significantly developed, so you now see it in Kenya, you now have it in Nigeria. And of course, as the ecosystem matures, more opportunities come, and therefore, you will see private exchanges where you see the big exchange, global exchanges you have present in some of the African countries.

So I can say yes, if there is an opportunity, and the industry has significantly matured. And then there is a gap that is not addressed by the existing exchange points because usually those new exchanges are set up to address a gap. So I will urge the existing exchange points in Africa to ensure that there is no gap by providing world standard, you know, services and, therefore, there is no gap or opportunity for others to set up. But no matter how you do it, some data centers will come up with exchange points, so it's very possible.

I hope I answered this question.

**GHISLAIN NKERAMUGABA:** Thank you. Thank you, Muhammed.

There is a question from Andrew Baskett: Do you have statistics on the end to end reliability of the West Africa Orange network?

Okay. There is a question from Kouattara, I think it's for Ben: What are the challenges of Liquid Mombasa? Is it a service that other countries can benefit from?

**BEN ROBERTS:** I am not sure I understand the question there.

**GHISLAIN NKERAMUGABA:** Are you intending to diverge from your hub to hub links? Are you planning to include other countries in your planning?

**BEN ROBERTS:** Very much so, yeah. West Africa is a big push to expand in West Africa. But also adding in other countries, you know, that are not part of the network. But yeah. We see a lot of potential growth. We've got a lot of border links that are crossing into countries where we are not present, like Malawi as well, so we are seeing a lot of expansion.

**GHISLAIN NKERAMUGABA:** Okay.

Okay. I think those are the questions that we have. Probably have a question for Brian. So you mentioned about the collaboration with exchange points building secure environment. So what's the process? So they write to you, and then you respond back? Or you go through a process into deploying into an exchange point, so on and so forth? So take us through the process that you go about joining an exchange point.

**BRIAN DAVENPORT:** Yeah, yeah. So I think one of the cool things is so if we are talking about just like the NetFlow collector portion, so part of, I think, what Team Cymru does really well is there are some discussion about, like, an ISP might be running a very small staff or might not have the money available to purchase some kind of like enterprise solutions or might not know how to configure NetFlow or something like that. What's nice is they are cloud, so you don't have to put on premise or spin up virtual appliances or anything like that. In order to sign up for a service, typically what we do is like an ISP, or like if we have an Internet exchange point that wants to advertise Nimbus to their customers or whatever, or if you are just an ISP that's part of an exchange, typically they would go to the website and fill out a form, what's your ASN, what's your IP address, all that kind of stuff. Because we do incur a cost for each Nimbus we spin up, there is a little bit of vetting to make sure it's an actual Internet service provider, but from there we just create a collector, and they send NetFlow data into it, and they get like a Kibana interface to explore the traffic, and everybody's data is their own data. So it's pretty clear.

Then for bogon or UTRS, it's just a peering that you set up. It's just signing up on the website for that.

**GHISLAIN NKERAMUGABA:** Okay. Thank you very much.

Jean Baptiste.

(Speaking French)

**JEAN-BAPTISTE MILLOGO:** Yes, if Ndiogou is not with us, maybe I can try to answer.

**GHISLAIN NKERAMUGABA:** There is a question: What are the statistics for the end to end reliability from one country to another in the Djoliba Orange network? What is the degree of security of the system, the network?

**JEAN-BAPTISTE MILLOGO:** I don't have all the statistics to answer this question fully, but I am sure Ndiogou will be able to answer it directly later in the Q&A and provide all the relevant statistics. But in terms of availability, with the level of resilience that we achieve, we connect the POPs, the reliability is pretty good, but sometimes a function of meteorological disturbances.

**GHISLAIN NKERAMUGABA:** And what about presence on an exchange point? On how many IXPs is Djoliba present?

**JEAN-BAPTISTE MILLOGO :**In the case of Burkina, there are two POPs that are connected. So that's the two IXPs, the two POPs in Burkina.

**NDIOGOU FALL:** Sorry, hello, Ghislain. I had a technical problem.

**GHISLAIN NKERAMUGABA:** I think that Jean Baptiste was able to answer the questions, but thank you very much.

It is the ends of the session. I want to thank everyone, all our speakers. I don't know if you have a few seconds, your parting remarks, one or two last parting remarks? Few seconds?

**BRIAN DAVENPORT:** Yeah, this is Brian with Team Cymru. I just want to say thank you all for your time, and a bunch of people connected with me on LinkedIn, so that's awesome. So thank you for doing that. Have a great rest of your day.

**GHISLAIN NKERAMUGABA:** Thank you, Brian. Ben?

**BEN ROBERTS:** Yeah, I just want to say having this kind of regional event is good because we have got some sort of gaps in inter regional peering, and this West African region is one good example. I think it's great to bring the conversation down at regional level as well as the conversations we have at continental level. So thank you for the initiative of this event, thanks to ISOC and sponsors.

**GHISLAIN NKERAMUGABA:** Thank you. Muhammed and Aderemi?

**MUHAMMED RUDMAN:** Yes, okay. I just want to echo what Ben said. Doing these discussions at the regional level. Thank you, ISOC, for organizing this, and thanks to the audience, the huge number of people that participated, and some of them are still here. Thank you so much for joining this session. Looking forward to seeing you again when there is another program for the West African region. Thank you.

**GHISLAIN NKERAMUGABA:** Thank you. Thank you, thank you. Aderemi?

**ADEREMI ADEJUMO:** Thank you, Ghislain and team, for the opportunity. It's been educational for me hearing from the other speakers as well as understanding a bit more about the region. I look forward to the growth of the region in every facet that we have talked about today. Thank you very much.

**GHISLAIN NKERAMUGABA:** Thank you. Thank you. Ndiogou and Daniel?

**NDIOGOU FALL:** Okay. I think this was really interesting. We've learned a lot through the various presentations, and we hope that West Africa will be well connected because it's simple that all major African capitals be connected because it will help us to connect the more remote areas as well and the landlocked areas.

**GHISLAIN NKERAMUGABA:** I want as well to thank the sponsors of the event, AFRINIC, MainOne, Flexoptix, RackCentre, Facebook, Team Cymru, and PAIX. Thank you very much.

So the discussion is continuing, and I want to bring to your attention the forthcoming event. We have the Virtual Peering Series. They are different from the Regional Peering Series, which focus on region. The Virtual Peering Series are focused on the whole continent of Africa. We have the 11th event coming up on 3rd of August at 1300 UTC. And we have as well another event, the Africa Peering Series Africa 12 event. It will happen the 2nd of November 2021, the same time, 1300.

We have one other thing coming up, a very good set of panelists. The theme is about Fear to Peer Post Pandemic, What is the Future of Handshake Peering? We have speakers from Euro IX. We have Rebecca from Euro IX, we have Ester from CZ, we have Yolandi from Teraco, we have Nico who is managing KINIX, and forthcoming data exchange point as well. So we have sponsors for that event, Flexoptix, Facebook, PAIX, NAPAfrica, and Microsoft that are as well supporting that event. So on that, I want to say thank you for everyone. Sorry we have been we are over a few minutes on the time that was allotted to us, but thank you for staying connected, and let the conversation continue.

Thank you very much, everyone, and see you next time. Thank you.